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Safety Measures for Construction Heavy Equipment Operations

Introduction

On June 20, 1997, a construction laborer was killed when he was struck by a wheel loader performing grading operations on a pipeline project at Brookhaven National Laboratory. Although the wheel loader was equipped with a functioning back-up alarm, the laborer either did not hear it or did not react to the signal in time to move from the path of the reversing vehicle. The laborer and the wheel loader's operator, the only people on the project site at the time of the accident, had many years of construction experience and had both recently completed training in which the hazards of working around heavy equipment were emphasized.

Although the hazards of heavy equipment operations are widely recognized across the construction industry, accidents of this type are all too common. In its "Analysis of Construction Fatalities - The OSHA Database 1985-1989," the Occupational Safety and Health Administration (OSHA) reported that approximately ten percent of the 3,496 fatal construction accidents investigated during that time period occurred as a result of workers being struck by construction heavy equipment. In discussions with the principle author of this report, it was noted that the most common job classification of worker killed in such accidents was "signalman" — the very person assigned responsibility to ensure safe movement of the equipment. These facts seem to clearly underscore that inattentiveness or the casual dismissal of the hazards involved in heavy equipment operations can have swift and deadly consequences.

Applicable OSHA Standards

The OSHA standard pertinent to construction motor vehicles and heavy equipment operations, 29 CFR 1926, Subpart O, requires under provisions 29 CFR 1926.601(b)(4)(i) and 1926.602(a)(9)(ii) that all vehicles and heavy equipment having an obstructed view to the rear either be equipped with a reverse signal alarm (i.e., back-up alarm) or use a signalperson for reverse operations. When a signalperson is used, OSHA requires the use of high visibility clothing only in instances where there is exposure to public vehicular traffic (29 CFR 1926.651(d)). However, as demonstrated by the recent Brookhaven accident and OSHA's fatality data, sole reliance on these prescribed control measures, though certainly helpful, does not guarantee safe heavy equipment operations. In fact, it is widely believed that workers can become accustomed to the sound of back-up alarms on construction sites, thereby reducing their effectiveness in controlling such accidents.

New Alarm Technologies

Concerns about the continued hazards of heavy equipment operations have led industry to develop supplementary control measures to warn equipment operators and ground personnel of people or objects in the operator's obstructed view zone. Such measures include rear viewing video cameras and proximity alarms (also known as discriminating back-up alarms). Though these technologies have been used to a limited degree in the mining and service industries (on powered haulage equipment and service trucks or buses, respectively), they are rarely used in the construction industry. Discussions with manufacturers of construction heavy equipment have indicated a reluctance to use such technology until it has been proven to be both safer and more reliable than existing control methodologies.

Discriminating back-up alarms are allowed by the Mine Safety and Health Administration (MSHA) on self-propelled mobile equipment engaged in surface mining operations in lieu of conventional back-up alarms or spotter personnel, whereas OSHA standards do not make specific mention of this technology. In fact, in a July 12, 1993 letter of interpretation to the above noted motor vehicle standard, OSHA expressed only qualified acceptance of this technology while expressing concern about its ability to warn "persons walking towards the path of the vehicle in time to avoid contact …" with it.

The National Institute for Occupational Safety and Health (NIOSH) has recently initiated a study on surface mining powered haulage equipment to determine the relative reliability and effectiveness of these new technologies as compared to conventional back-up alarms and spotter personnel. This study is being undertaken in recognition of the fact that personnel contact with haulage equipment is the largest single cause of surface mining fatalities. A NIOSH Technical News Bulletin detailing the results of this study is scheduled for publication in December 1997. Preliminary indications are that with proper installation and tuning, discriminating alarms can be effective. However, issues such as mounting height and changes in ground texture and contour can adversely effect alarm actuation. With regard to rear viewing video cameras, factors which limit visibility (e.g., darkness, rain, fog, dust, dirt on equipment) can greatly reduce their effectiveness. Furthermore, they require the operator to briefly look away from ongoing operations to view the cab mounted monitors.

The Society of Automotive Engineers (SAE) has also started work on a draft standard intended for use as a test procedure for discriminating back-up alarms on off-road construction and general industry vehicles. When finished, this standard will define performance requirements for discriminating alarms including minimum detection zones, testing methodology, and required test results for alarms addressed by the standard.

Recommendations

Until technological improvements result in control measures that are widely available, reliable and effective as further means of improving the safety of heavy equipment operations, conventional back-up alarms or spotters will remain the accepted practices in the construction industry. Continued reliance on these practices, however, will require diligence on the part of project safety staff and onsite workers to ensure safe heavy equipment operations.

Recommended practices include:

- Daily equipment checks to ensure proper functioning of back-up alarms.
- Use of high visibility clothing for personnel working near heavy equipment even when work area is not exposed to public vehicular traffic.
- Limiting access to areas around heavy equipment operations to only those workers needing access.
- Instructing operators only to move equipment when they are aware of the whereabouts of all workers near the equipment and its planned path.
- Instructing employees working near heavy equipment to maintain eye contact with the operator to the greatest extent possible and to allow ample distance for passing equipment to compensate for sudden or erratic changes in the equipment course.

For more information, contact Mr. Pat Finn, Office of Occupational Safety and Health Policy, EH-51, at 301-903-9876.

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